

I CLAIM:

1. A toggle switch comprising:

a negative pole;

a cathode having a plurality of contact nodes;

5 a switch connecting the negative pole to each contact node in a time sharing mode;

said time sharing mode comprising a momentary overlap between switched members of the plurality of contact nodes; and

10 a time sharing frequency controller to control a time sharing frequency amongst the plurality of contact nodes, thereby allowing an arc to discharge continuously between the cathode and an anode.

15 2. The apparatus of claim 1, wherein the negative pole further comprises a constant contact mechanism with a rotating switch pole.

3. The apparatus of claim 2, wherein the constant contact mechanism further comprises a shaft around which
20 rotates the rotating switch pole, said rotating switch pole further comprising a cylindrical body having at least one insulated segment and one conductive segment, wherein the insulated and the conductive segments alternately contact a fixed first contact which is electrically connected to a
25 first cathode contact node and alternately contacts a fixed second contact which is electrically connected to a second cathode contact node.

4. The apparatus of claim 3, wherein the anode further comprises an inside segment of an interior wall of a
30 vacuum chamber, the cathode is mounted inside the vacuum

chamber, and the switch is mounted outside the vacuum chamber.

5 5. The apparatus of claim 4, wherein the time sharing frequency controller further comprises a variable speed motor rotating the rotating switch pole.

6. The apparatus of claim 3, wherein the fixed first and second contact each further comprise an electrical contact brush.

10 7. A current toggle switch for a cathode in a vacuum chamber, said current toggle switch comprising:

 a cathode means functioning to form an arc between itself and an anode means;

15 said cathode means having at least two contact node means functioning to steer the arc across a target surface of the cathode means; and

20 a current switching means functioning to controllably direct a current flow from one contact node means to another contact node means and provide a momentary overlap of the current between the first and second contact node means.

25 8. The apparatus of claim 7, wherein the current switching means further comprises a variable speed motor rotating a disc means having a conductive segment and a non-conductive segment, wherein the conductive segment alternately electrically contacts a contact node means.

9. In a vacuum arc deposition system having a vacuum chamber, an anode and a cathode, wherein an arc discharges between the anode and the cathode, an improvement comprising:

30 a cathode having a plurality of electrical contacts;

 a rotating cathode current source; and

a fixed electrical contact hub for each electrical contact; and

wherein the rotating cathode current source contacts each fixed electrical contact hub to provide a momentary overlap of current between a pair of fixed electrical contact hubs before directing all the current to the next member of the pair of fixed electrical contact hubs, thereby causing the arc to be steered by the movement of current amongst the plurality of electrical contacts in a continuous manner without interruption.

10. The improvement of claim 9, wherein the rotating cathode current source further comprises a disc having a peripheral contact edge, said edge having a conductive and a non-conductive segment.

11. The improvement of claim 10, wherein the rotating cathode current source further comprises a central shaft supplying the cathode current to the conductive segment.

12. The improvement of claim 11 further comprising a variable speed motor to rotate the rotating cathode current source.

13. In a vacuum arc deposition system having a vacuum chamber, an anode and a cathode, wherein an arc discharges between the anode and the cathode, an improvement comprising:

a cathode having a plurality of electrical contacts;

a rotating cathode current source;

a fixed electrical contact hub for each electrical contact;

wherein the rotating cathode current source
contacts each fixed electrical contact hub to
provide a momentary overlap of current between a
pair of fixed electrical contact hubs before
directing all the current to the next member of
the pair of fixed electrical contact hubs,
thereby causing the arc to be steered by the
movement of current amongst the plurality of
electrical contacts in a continuous manner
without interruption;

wherein the rotating cathode current source further
comprises a disc having a peripheral contact
edge, said edge having a conductive and a non-
conductive segment;

wherein the rotating cathode current source further
comprises a central shaft supplying the cathode
current to the conductive segment; and

wherein a variable speed motor rotates the rotating
cathode current source.

14. In a vacuum arc deposition system having a vacuum
chamber, an anode and a cathode, wherein an arc discharges
between the anode and the cathode, an improvement
comprising:

a cathode having a plurality of electrical
contacts;

a reciprocating cathode current source;

a fixed contact hub connected to each cathode
electrical contact; and

wherein the reciprocating cathode current source
sequentially contacts each fixed contact hub to

provide a momentary overlap of current before directing all the current to the next fixed contact hub to be contacted, thereby causing the arc to be steered by the movement of current between the plurality of cathode electrical contacts in a continuous manner without interruption.

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15. In a vacuum arc deposition system having a vacuum chamber, an anode and a cathode, wherein an arc discharges
10 between the anode and the cathode, an improvement comprising:

a plurality of cathodes each having a plurality of electrical contacts;

15 a switching cathode current source to provide an arc simultaneously to each cathode;

said switching cathode current source having a separate switch for each cathode; and

20 wherein the switching cathode current source contacts a first and a second electrical contact on each cathode to provide a momentary overlap of current between them before directing all the current to the next contact in line to be contacted, thereby causing several arcs each to be steered by the movement of current between
25 the plurality of cathode electrical contacts on each cathode in a continuous manner without interruption.

16. A current toggle switch for a cathodic arc, said switch comprising:

30 a negative pole;

a cathode body having a plurality of contact nodes;
an anode;
a power supply to sustain an arc between the
cathode and the anode;
5 a switch connecting the negative pole to each
cathode contact node in a time sharing mode; and
a time sharing frequency controller to control a
time sharing frequency amongst the plurality of
cathode contact nodes.

10 17. The apparatus of claim 16, further comprising:

a cathodic arc target attached to a cathode body;
said cathodic arc target having an erosion surface;
an insulator member of electronically non-
conductive material, said insulator member being
15 disposed around said cathode body and insulating
said cathode body from the walls of said
chamber;
said cathode body being positioned within said
insulator member and said cathodic arc target
20 being positioned in electrical contact with said
cathode body, a gap between the cathode body and
the insulator member, and a gap between the
cathodic arc target and the insulator member;
said insulator member cross-section having a "C"
25 shape, with a pair of ends aligned with a plane
of the target erosion surface;
said cathode body having a back side; and
a magnet mounted to the back side so as to face the
insulator member.

30 18. In a vacuum arc deposition system having a vacuum
chamber, an anode and a plurality of cathodes, wherein an

arc discharges between the anode and each cathode, an improvement comprising:

each cathode having a plurality of electrical contacts;

5 a cathode current controller;

said cathode current controller having a current input, a plurality of current outputs, a logic module to control desired combinations of inputs to outputs; and

10 wherein the cathode current controller for each cathode sequentially contacts a first and a second electrical contact to provide a momentary overlap of current between them before directing all the current to the second electrical
15 contact, then repeating the process to the next in line to be contacted, thereby causing an arc on each cathode to be steered by the movement of current between the plurality of cathode electrical contacts in a continuous manner
20 without interruption.

19. A starter for an arc in a cathodic arc vapor deposition chamber, said starter comprising:

a cathode having a negative potential;

a target attached to the cathode;

25 a striker assembly attached to the target;

said striker assembly comprising an electrically insulating solid core having a conductive outer surface;

30 said conductive outer surface having a physical contact with the target;

a switch connected between the striker's conductive outer surface and a source of a different potential than the cathode;

wherein a momentary closure of the switch causes a current flow through the conductive outer surface, thereby depleting the conductive outer surface and creating a spark to initiate an arc to an anode; and

wherein the target re-coats the striker during a cathodic arc deposition process.

20. A cathodic arc cathode within a chamber, said cathode having a cathodic arc target, said cathodic arc target having an arc evaporation surface;

a cathode body;

an insulator member of electronically non-conductive material, said insulator member being disposed around said cathode body and insulating said cathode body from the walls of said chamber;

said cathode body being positioned within said insulator member and said cathodic arc target being positioned in electrical contact with said cathode body, a gap between the cathode body and the insulator member, and a gap between the cathodic arc target and the insulator member;

said insulator member cross-section having a "C" shape, with a pair of ends aligned with a plane of a target arc evaporation surface; and

an adjustment mechanism to adjust the pair of ends to maintain the alignment with the target arc

evaporation surface as the target arc
evaporation surface erodes.

21. A toggle switch comprising:

a negative pole;

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a cathode having a plurality of contact nodes;

a switch connecting the negative pole to each
contact node in a time sharing mode;

said time sharing mode comprising a momentary
overlap between switched members of the
plurality of contact nodes;

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a time sharing frequency controller to control a
time sharing frequency amongst the plurality of
contact nodes, thereby allowing an arc to
discharge continuously between the cathode and
an anode; and

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said cathode having a back side with a magnet
mounted thereon.

22. A toggle switch comprising:

a negative pole;

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a cathode having a plurality of contact nodes;

a switch connecting the negative pole to each
contact node in a time sharing mode;

said time sharing mode comprising a momentary
overlap between switched members of the
plurality of contact nodes;

25

a time sharing frequency controller to control a
time sharing frequency amongst the plurality of
contact nodes, thereby allowing an arc to
discharge continuously between the cathode and
an anode;

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a target mounted to the cathode and having an erosion surface; and
said erosion surface having a pattern of grooves, thereby causing a pattern of vapor flux to focus on a workpiece.

23. A toggle switch comprising:

a negative pole;
a cathode having a plurality of contact nodes;
a switch connecting the negative pole to each contact node in a time sharing mode;
said time sharing mode comprising a momentary overlap between switched members of the plurality of contact nodes;
a time sharing frequency controller to control a time sharing frequency amongst the plurality of contact nodes, thereby allowing an arc to discharge continuously between the cathode and an anode; and
wherein the cathode is powered by a pulsing current.

24. A toggle switch comprising:

a negative pole;
a cathode having a plurality of contact nodes;
a switch connecting the negative pole to each contact node in a time sharing mode;
said time sharing mode comprising a momentary overlap between switched members of the plurality of contact nodes;
a time sharing frequency controller to control a time sharing frequency amongst the plurality of contact nodes, thereby allowing an arc to

discharge continuously between the cathode and an anode; and

a cathodic arc deposition chamber comprising:

the cathode having a target mounted thereon;

5 an anode member disposed around said cathode forming an air gap between the back side of the cathode and the anode; and

wherein an arc travels between a target surface and the anode.

10 25. A cathodic arc deposition chamber comprising:

a cathode body having a target mounted thereon;

an anode member disposed around said cathode forming an air gap between the back side of the cathode and the anode; and

15 wherein an arc travels between a target surface and the anode.

26. A toggle switch comprising:

a negative pole;

a cathode having a plurality of contact nodes;

20 a switch connecting the negative pole to each contact node in a time sharing mode;

said time sharing mode comprising a momentary overlap between switched members of the plurality of contact nodes;

25 a time sharing frequency controller to control a time sharing frequency amongst the plurality of contact nodes, thereby allowing an arc to discharge continuously between the cathode and an anode; and

30 wherein the cathode is a cylinder which supports a cylindrical target mounted on an inside surface

thereof, thereby facilitating a coating of an outside surface of a workpiece disposed inside the cyclinder.

27. The apparatus of claim 26, wherein the cylinder is
5 elongated having at least two pairs of electrical contacts.

28. A toggle switch comprising:

a negative pole;

a cathode having a plurality of contact nodes;

10 a switch connecting the negative pole to each contact node in a time sharing mode;

said time sharing mode comprising a momentary overlap between switched members of the plurality of contact nodes;

15 a time sharing frequency controller to control a time sharing frequency amongst the plurality of contact nodes, thereby allowing an arc to discharge continuously between the cathode and an anode;

20 said cathode further comprises a cathode cylindrical body having an outer surface to support a cylindrical target, thereby facilitating a coating on a workpiece disposed around the cylindrical target.

25 29. A target for mounting on a cathode, said target comprising:

an erosion surface;

said erosion surface having a pattern of grooves,

thereby causing a pattern of vapor flux to focus on
30 a workpiece.